Interacting Disturbances in Managed Landscapes: Consequences for Fire Risk

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Funded by the National Fire Plan

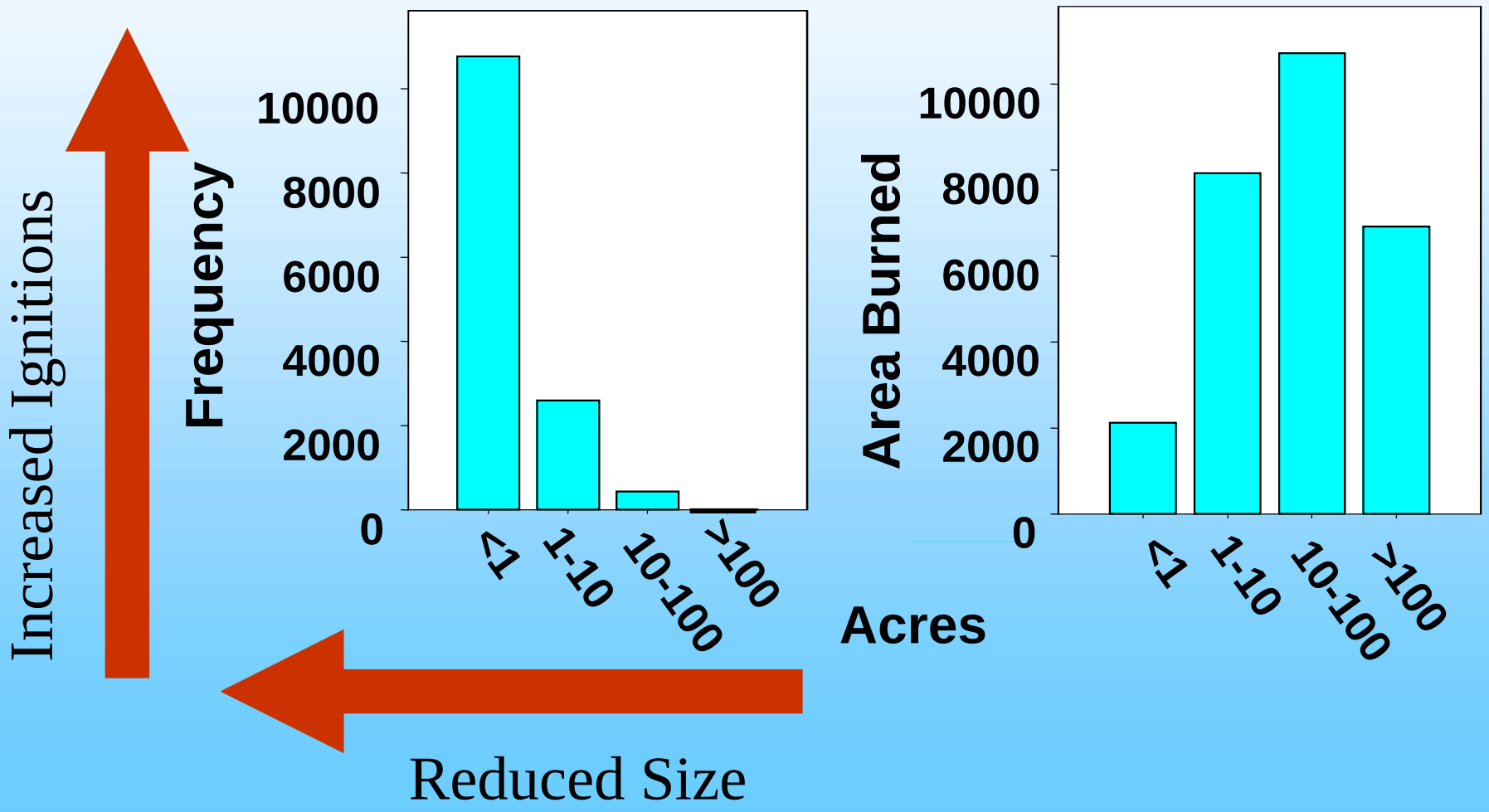
Introduction

Fire ignition and spread within a landscape is determined by complex interactions among:

- Forest succession
- Human fire policies
- Forest management patterns
- Other natural disturbance
  - Wind, Insect
- Abiotic environment
  - Climate, Soils, etc.

Modern Fire Regime

Northern Wisconsin (1985-2000).

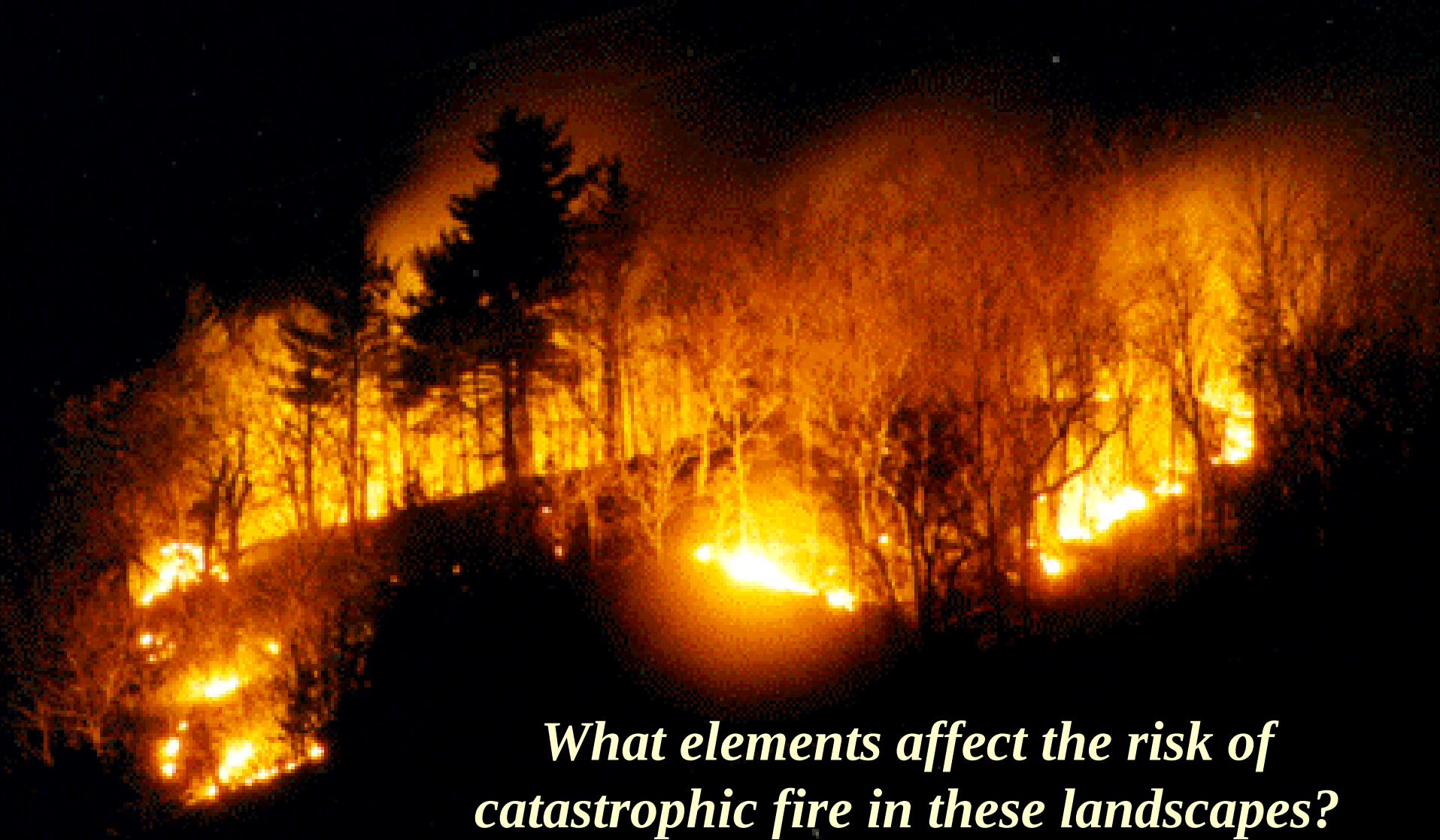


Western Fire Paradigm

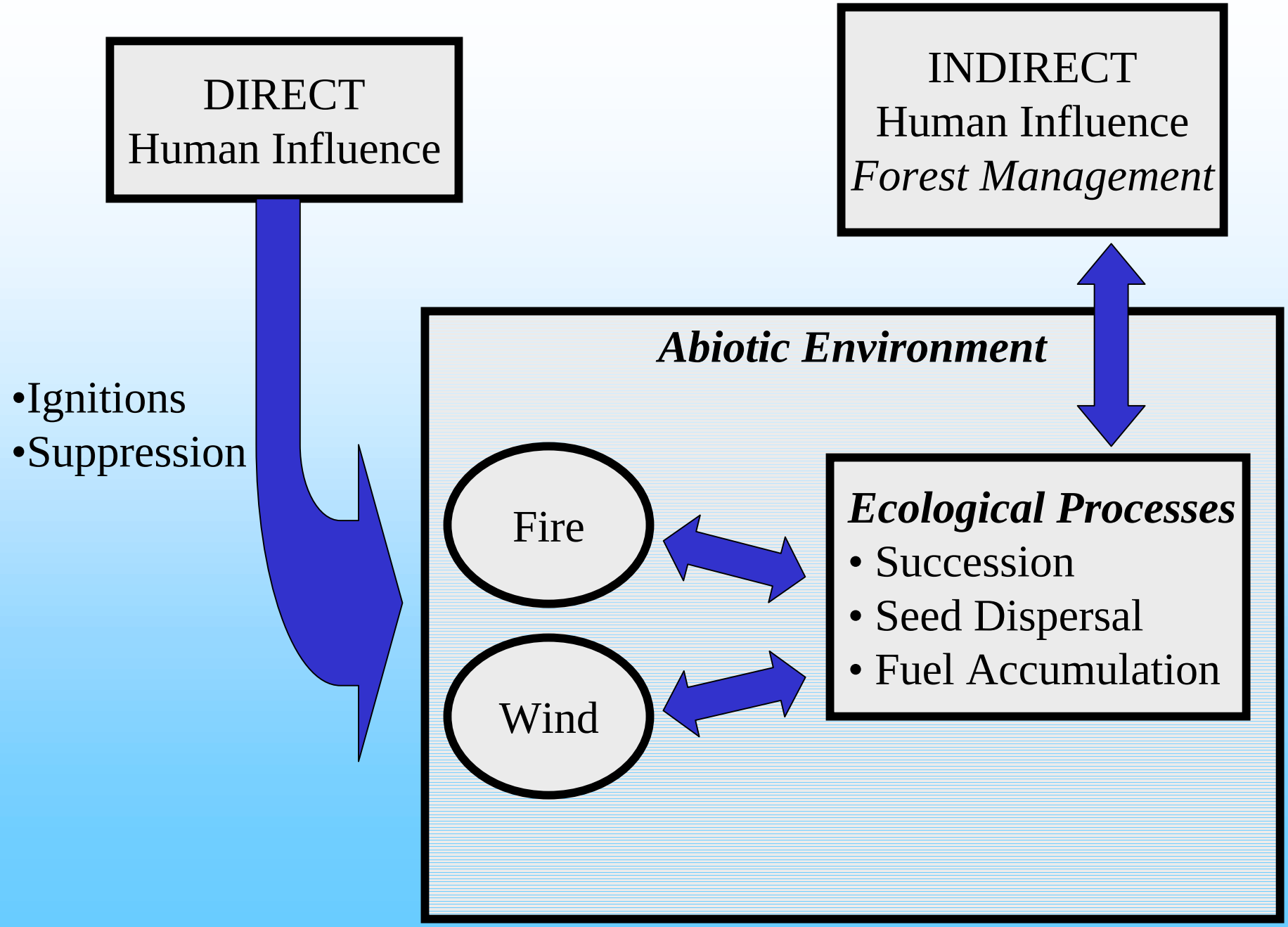
- Fuels increase with time
  - Fine Fuels
  - Fallen Logs
  - Highly Flammable Shade-Tolerant Species

- ***Catastrophic Fire Risk Increases under Fire Suppression***

Fires in Northern Mixed-wood Forests



What elements affect the risk of catastrophic fire in these landscapes?


DIRECT
Human Influence
INDIRECT
Human Influence
Forest Management
•Ignitions
•Suppression
Abiotic Environment
Fire
Wind
Ecological Processes
• Succession
• Seed Dispersal
• Fuel Accumulation

Research Question

How do humans influence the risk of catastrophic fire in a northern mixed forest landscape?

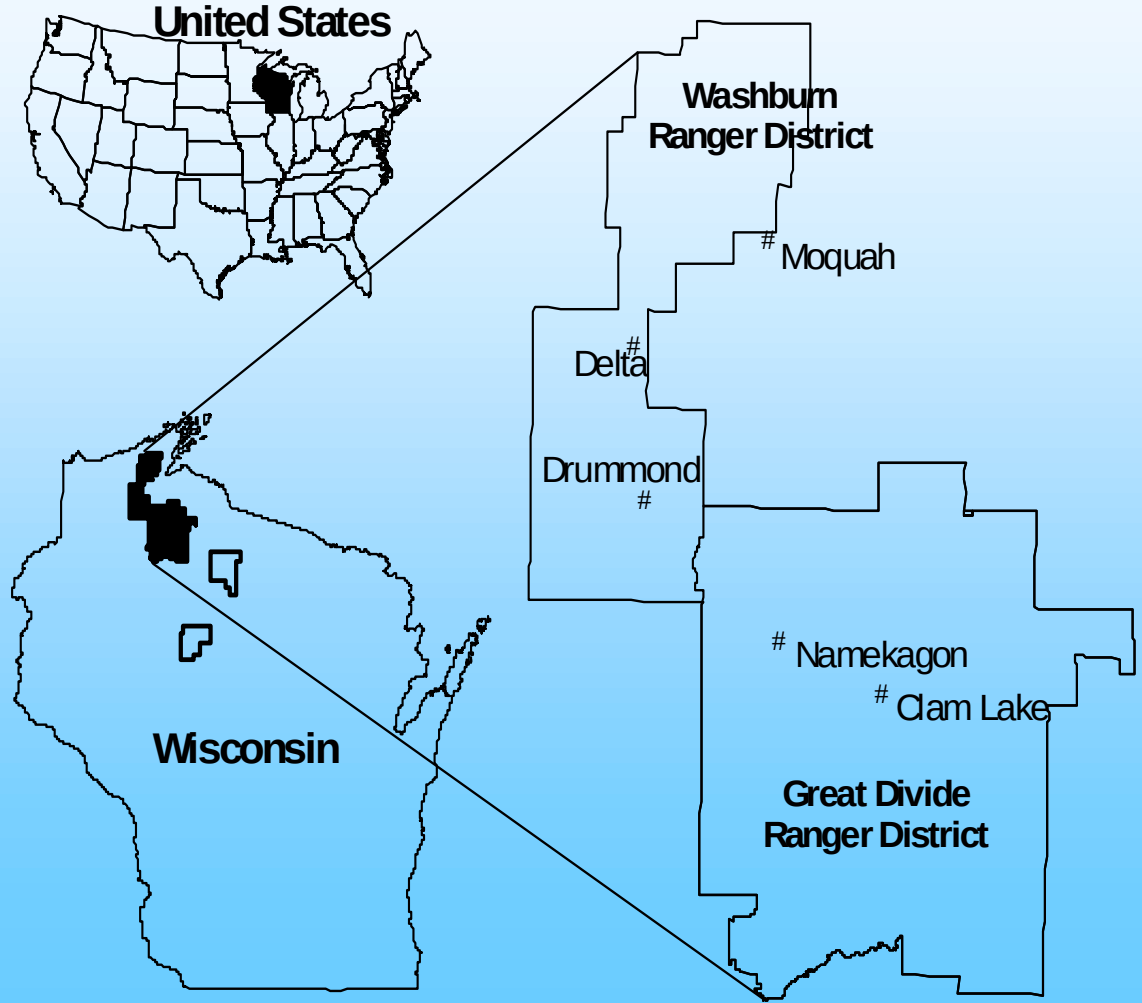
We evaluated how humans affect the risk of catastrophic fire by influencing the pattern of two high risk fuel sources (windthrow and conifers) through:

- ***Suppression of surface fires (Direct)***
- ***Forest harvesting (Indirect)***

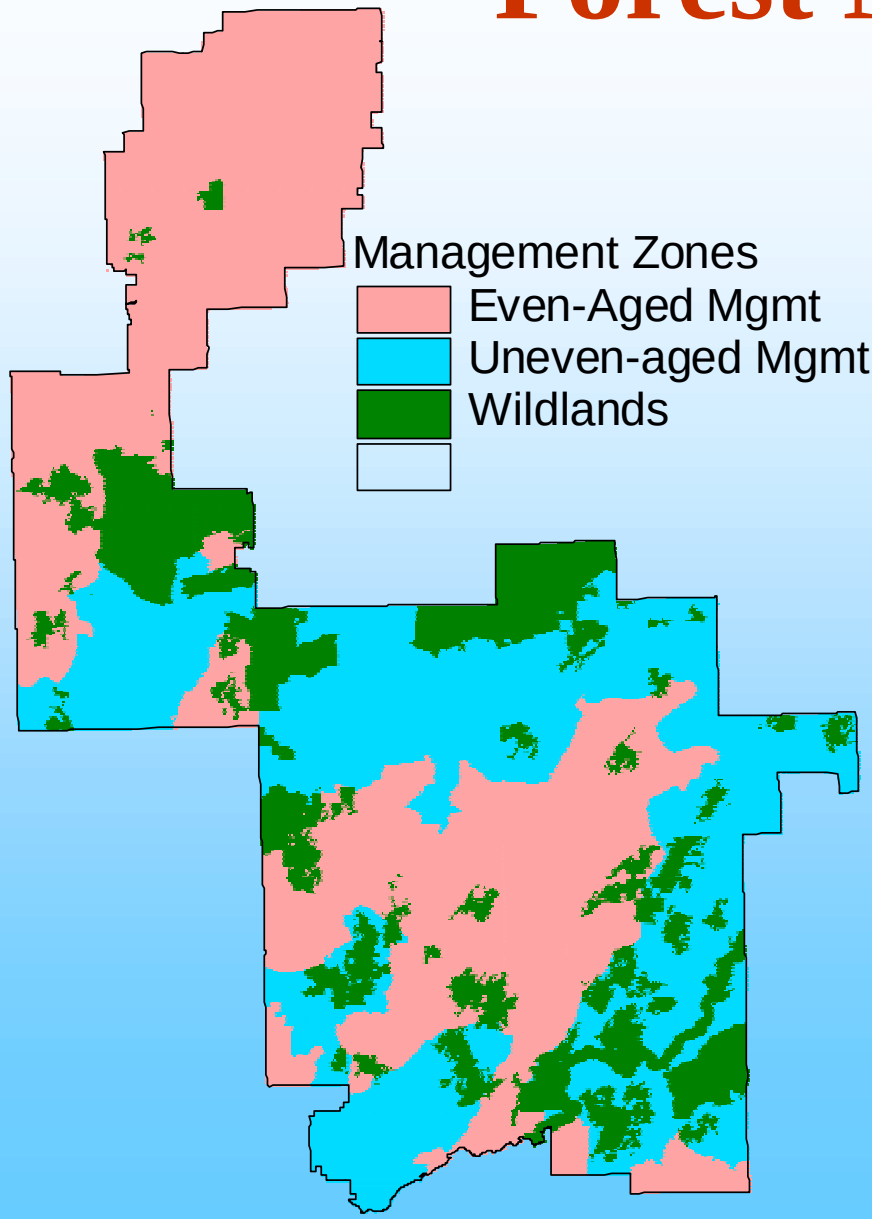
LANDIS
Disturbance and Succession Simulation Model

- Strategic-level research and planning tool
- Designed to predict expected spatial pattern of age classes and forest types across large landscapes
- Includes user-defined but stochastic disturbance regimes
- Harvest module allows objective comparison of the effects of alternative management strategies

Study Area


United States
Washburn
Ranger District
Moquah
Delta
Drummond
Namekagon
Clam Lake
Great Divide
Ranger District
Wisconsin

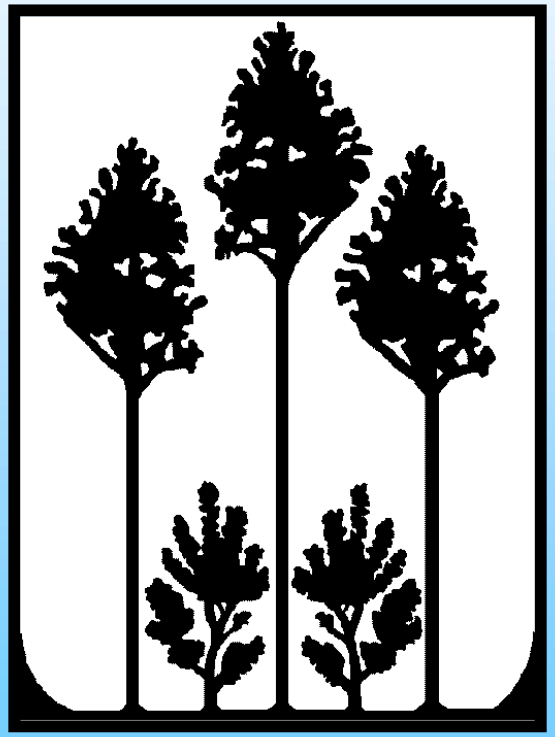
Forest Management



- *Harvest Module* used to simulate harvesting in three simplified management zones

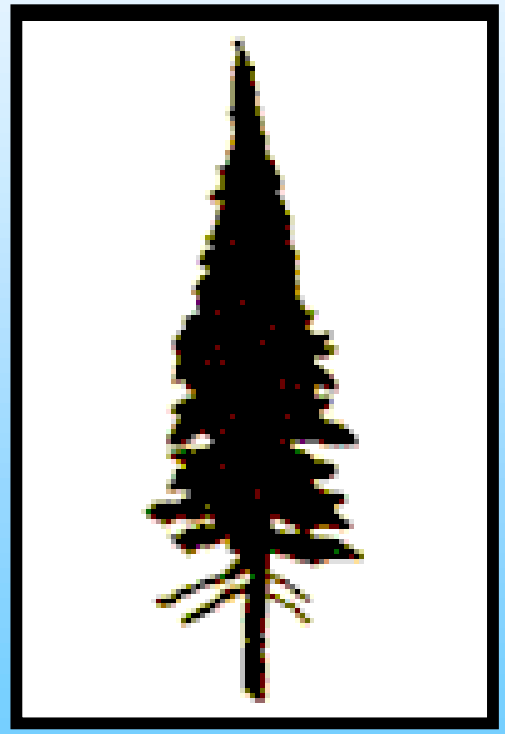
High Risk Fuels

Young Self-Pruning Conifers



Red & White Pine

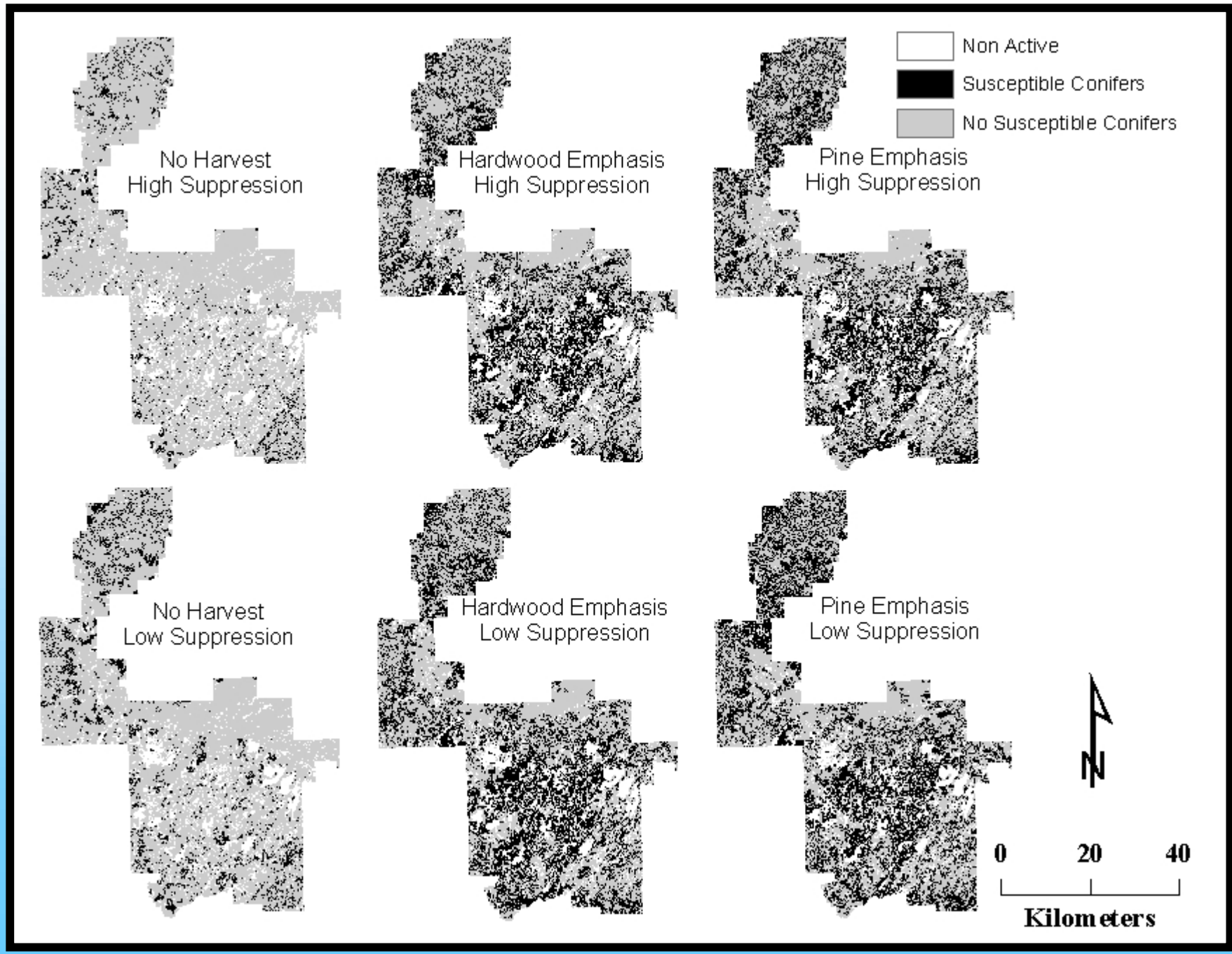
Most non Self-Pruning Conifers



Jack Pine, fir, spruce & cedar

Eastern Hemlock

Recent (30-year) Windthrow


Non Active
Susceptible Conifers
No Susceptible Conifers
No Harvest
High Suppression
Hardwood Emphasis
High Suppression
Pine Emphasis
High Suppression
No Harvest
Low Suppression
Hardwood Emphasis
Low Suppression
Pine Emphasis
Low Suppression
N
0
20
40
Kilometers

No Harvest
High Suppression

Hardwood Emphasis
High Suppression

Pine Emphasis
High Suppression

No Harvest
Low Suppression

Legend

Value

- Nonactive
- 10-30 yrs
- 40-60 yrs
- 70-90 yrs
- 100-120 yrs
- 130-150 yrs
- 160-180 yrs
- 190-210 yrs
- 220-240 yrs
- 250-270 yrs
- 280-300 yrs
- No Sugar Maple

N

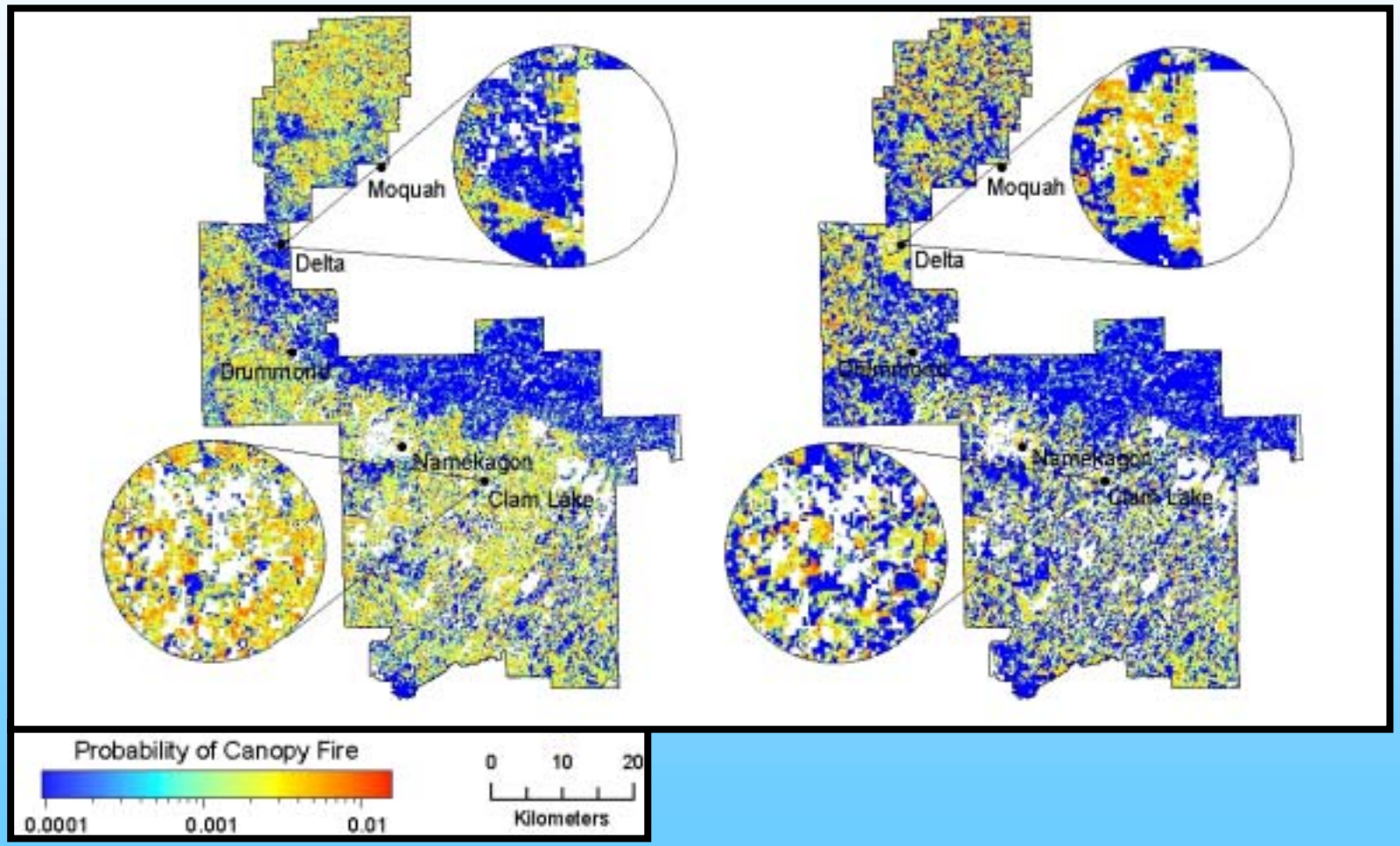
0 20 40

Kilometers

Spatial Predictions of Fire Risk

Forest Management Alternative

No Harvest Control



Conclusions

- *Disturbance in this system increases the risk of crown fires*
  - Both fire and harvesting reduce the dominance of fire resistant northern hardwood ecosystems
  - Disturbance favors boreal species that increase fire risk
  - Harvest practices that favor northern hardwoods should reduce fire risk.
  - The exception is that older forests are more susceptible to wind disturbance

LANDIS 4.x Modifications

- Explicit simulation of fuel
  - Fuel quantity and quality
  - Fine, coarse, and live fuel
  - Fuel may be manipulated by any disturbance
- Biomass – replaces age list as LANDIS "Currency"
- Human Influence (ignition & suppression)
- Biological Disturbances
  - Insects, disease

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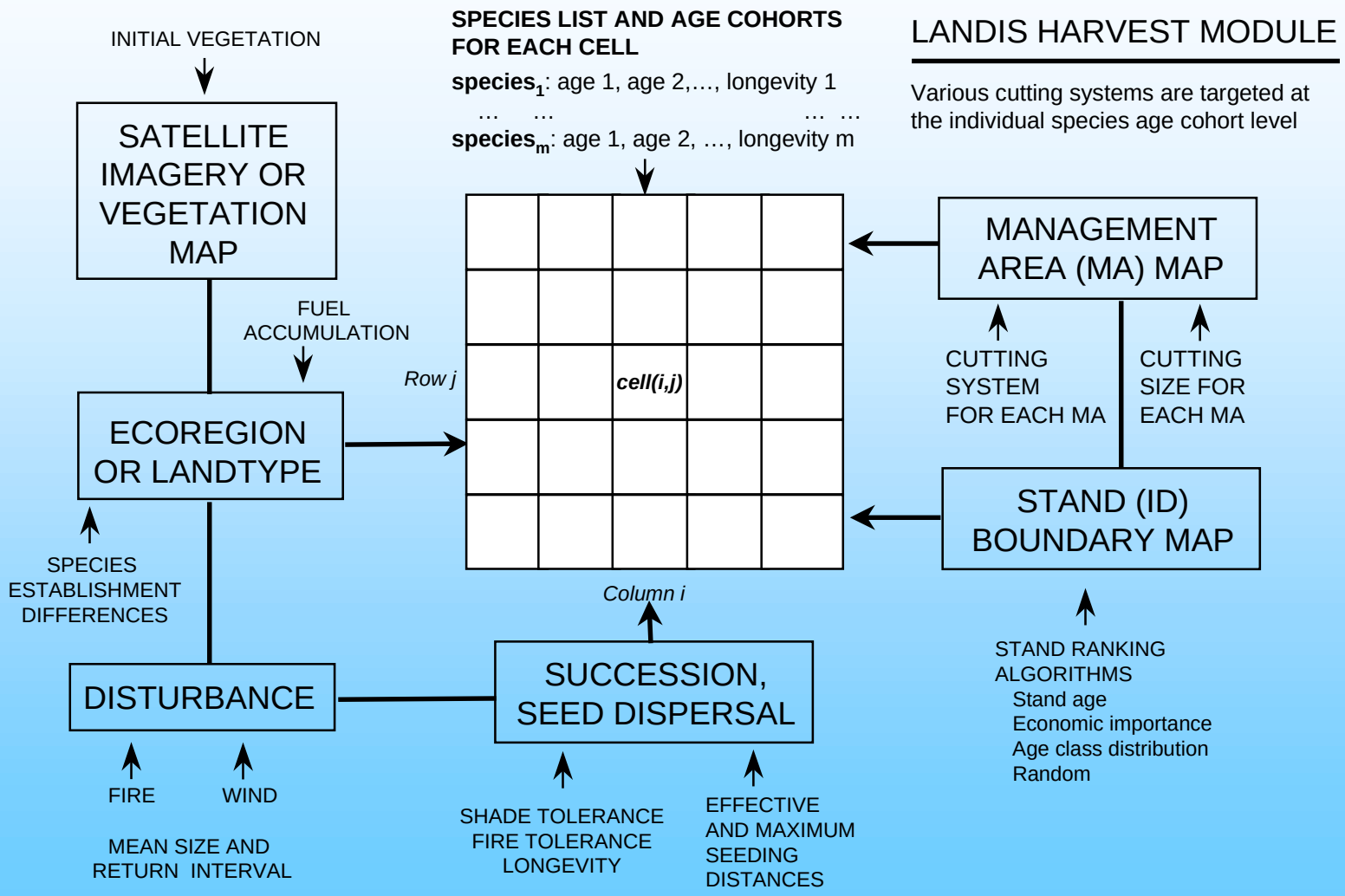
LANDIS Schematic



Gustafson et al. 2000 Can. J. For. Res. 30:32-43

Land Type Map